



2019 Astrophysics Medium Explorer (SMEX), and Mission of Opportunity (MO) Preproposal Conference

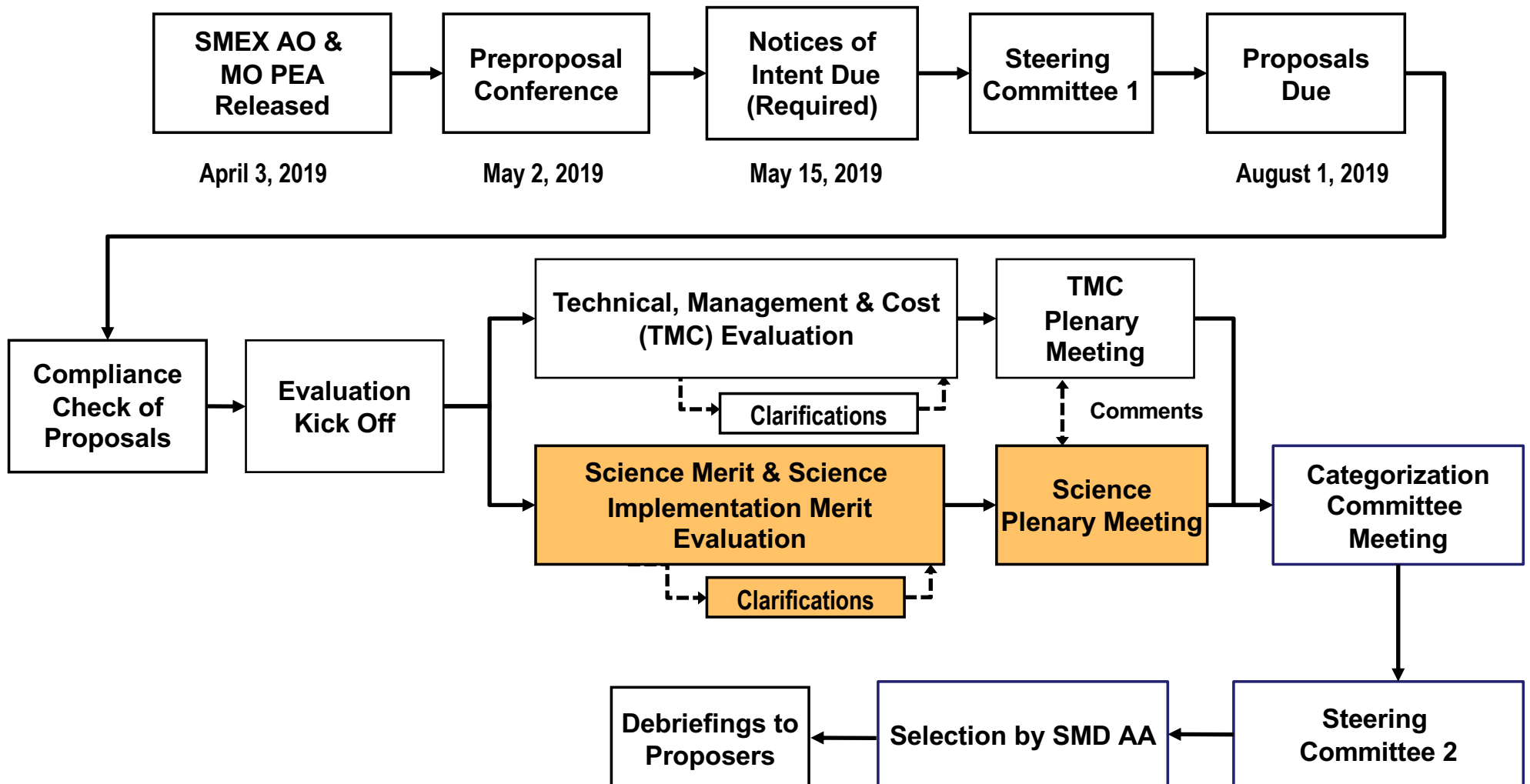
Science Evaluation Overview

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May 2, 2019



Proposal Evaluation Flow

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Science Requirements

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- All investigations proposed in response to this solicitation must support the goals and objectives of the Astrophysics Explorers Program.
- One of NASA's strategic objectives is to discover how the Universe works, explore how it began and evolved, and search for life on planets around other stars.
- The NASA Science Mission Directorate (SMD) addresses this strategic objective by conducting astrophysics investigations designed to:
 - Probe the origin and destiny of our Universe, including the nature of black holes, dark energy, dark matter and gravity;
 - Explore the origin and evolution of the galaxies, stars and planets that make up our universe;
 - Discover and study planets around other stars, and explore whether they could harbor life.
- NASA's Strategic Plan, the NASA Science Plan, and the Astrophysics Roadmap *Enduring Quests Daring Visions, NASA Astrophysics in the Next Three Decades*, are available in the Program Library.



Scientific Merit and Science Implementation Merit

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- The information provided in a proposal will be used to assess the **intrinsic scientific merit** (Form A) and the **science implementation merit** (Form B) of the proposed investigation.
- Scientific merit will be evaluated for the **Baseline Science Mission** and the **Threshold Science Mission**. At Step 1, Science Enhancement Options will not contribute to the assessment of the scientific merit of the proposed investigation.
- “**Baseline Science Mission**” is the mission that, if fully implemented, would fulfill the **Baseline Science Requirements**, which are the performance requirements necessary to achieve the full science objectives (Section 5.1.4, and Req B-16)
- “**Threshold Science Mission**” is a descoped mission that would fulfill the Threshold Science Requirements, the performance requirements necessary to achieve the minimum acceptable data and scientific return for the mission, below which the mission would not be worth pursuing. (Section 5.1.4, and Req B-18)



SMEX (and MO) Requirements (1)

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Requirement 4: Proposals shall describe a science investigation with goals and objectives that address the program science objectives described in Section 2.

Requirement 5: Proposals shall demonstrate how the proposed investigation will fully achieve the proposed objectives.

Requirement 6: Proposals shall clearly state the relationship between the science objectives, the data to be returned, and the instrument complement to be used in obtaining the required data (see Appendix B, Section D, for additional detail).

Requirement 7: Proposals shall include Data Plans to calibrate, analyze, publish, and archive the data returned, and shall demonstrate, analytically or otherwise, that sufficient resources have been allocated to carry out those Plans within the proposed mission cost. The data plan shall discuss and justify any data latency period (see Appendix B, Section E.4, Reqs B-23, B-24 for additional detail).



SMEX (and MO) Requirements (2)

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Requirement 8: Proposals shall state the specific science objectives and their required measurements at a level of detail sufficient to allow an assessment of the capability of the proposed mission to make those specific measurements and whether the resulting data will permit achievement of these objectives (see Appendix B, Sections D and E, for additional detail).

Requirement 9: Proposals shall describe the proposed instrumentation, including a discussion of each instrument and the rationale for its selection.

Requirement 10: Proposals shall specify only one Baseline Science Mission and only one Threshold Science Mission.

Requirement 11: Proposals shall not include any descopes or other risk mitigation actions that result in the mission being unable to achieve the Threshold Science Mission objectives.



Scientific Merit: Factor A-1

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Factor A-1. Compelling nature and scientific priority of the proposed investigation's science goals and objectives.

- This factor includes the clarity of the goals and objectives;
- how well the goals and objectives reflect program, Agency, and National priorities;
- the potential scientific impact of the investigation on program, Agency, and National science objectives;
- and the potential for fundamental progress,
- as well as filling gaps in our knowledge relative to the current state of the art.

AO Section 5.1.1 defines goals and objectives:

- A goal has a broad scope: e.g., discover whether life exists elsewhere in the Universe.
- An objective is a more narrowly focused part of a strategy to achieve a goal.
- Proposed investigations must achieve their proposed objectives; however, the investigation might only make progress toward a goal without fully achieving it.



Scientific Merit: Factor A-2

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Factor A-2. Programmatic value of the proposed investigation.

- This factor includes the unique value of the investigation to make scientific progress in the context of other ongoing and planned missions;
- the relationship to the other elements of NASA's science programs;
- how well the investigation may synergistically support ongoing or planned missions by NASA and other agencies; and
- the necessity for a space mission to realize the goals and objectives.



Scientific Merit: Factor A-3

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Factor A-3. Likelihood of scientific success.

- This factor includes how well the anticipated measurements support the goals and objectives;
- the adequacy of the anticipated data to complete the investigation and meet the goals and objectives; and
- the appropriateness of the mission requirements for guiding development and ensuring scientific success.

Requirement B-17: Traceability from science goals (through science objectives) to measurement requirements to instrument requirements (functional and performance), and to top-level mission requirements shall be provided in tabular form and supported by narrative discussion. Projected instrument performance shall be compared to instrument performance requirements.



Factor A-4. Scientific value of the Threshold Science Mission.

- This factor the scientific value of the Threshold Science Mission using the standards in Factor A-1 of this section, and whether that value is sufficient to justify the proposed cost of the mission.

Factors A-1 through A-3 are evaluated for the Baseline Science Mission, assuming it is implemented as proposed and achieves technical success.

Factor A-4 is similarly evaluated for the Threshold Science Mission.



Scientific Merit: Factor A-5

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Factor A-5. Scientific value of any Science Enhancement Options (SEOs) if proposed.

This factor includes assessing the potential of the SEO activities to enlarge the impact of the investigation.

Although evaluated by the same panel as the balance of Scientific Merit factors, this factor will not be considered in the overall criterion rating.



Scientific Implementation Merit and Feasibility: Factor B-1

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The information provided in a proposal will be used to assess merit of the plan for completing the proposed investigation, including the scientific implementation merit, feasibility, resiliency, and probability of scientific success of the proposed investigation.

- **Factor B-1. Merit of the instruments and mission design for addressing the science goals and objectives.**
- This factor includes the degree to which the proposed mission will address the goals and objectives;
- the appropriateness of the selected instruments and mission design for addressing the goals and objectives;
- the degree to which the proposed instruments and mission can provide the necessary data; and
- the sufficiency of the data gathered to complete the scientific investigation.



Scientific Implementation Merit and Feasibility: Factor B-2

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Factor B-2. Probability of technical success.

- This factor includes the maturity and technical readiness of the instruments, or demonstration of path to achieve necessary maturity;
- the adequacy of the plan to develop the instruments within the proposed cost and schedule;
- the robustness of those plans, including recognition of risks and mitigation plans for retiring those risks;
- the likelihood of success in developing any new technology that represents an untested advance in the state of the art;
- the ability of the development team - both institutions and individuals - to successfully implement those plans; and
- the likelihood of success for both the development and the operation of the instruments within the mission design.



Scientific Implementation Merit and Feasibility: Factor B-3

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Factor B-3. Merit of the data analysis, data availability, and data archiving plan.

- This factor includes the merit of plans for data analysis and data archiving to meet the goals and objectives;
- to result in the publication of science discoveries in the professional literature; and
- to preserve data and analysis of value to the science community.

Considerations in this factor include

- assessment of planning and budget adequacy and evidence of plans for well-documented, high-level data products and software usable to the entire science community;
- assessment of adequate resources for physical interpretation of data;
- reporting scientific results in the professional literature (e.g., refereed journals);
- and assessment of the proposed plan for the timely release of the data to the public domain for enlarging its science impact.



Scientific Implementation Merit and Feasibility: Factor B-4

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Factor B-4. Science resiliency.

- This factor includes both developmental and operational resiliency.
- Developmental resiliency includes the approach to descoping the Baseline Science Mission to the Threshold Science Mission in the event that development problems force reductions in scope.
- Operational resiliency includes the ability to withstand adverse circumstances, the capability to degrade gracefully, and the potential to recover from anomalies in flight.



Scientific Implementation Merit and Feasibility: Factor B-5

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Factor B-5. Probability of science team success.

- This factor will be evaluated by assessing the experience, expertise, and organizational structure of the science team and the mission design in light of any proposed instruments.
- The role of each Co-Investigator will be evaluated for necessary contributions to the proposed investigation;
- Inclusion of Co-Investigators who do not have a well defined and appropriate role may be cause for downgrading of the proposal.
- **Small Complete Missions of Opportunity** are Streamlined Class D payloads; accordingly, the scientific expertise of the PI will be evaluated but not his/her experience with NASA missions.
Comments about the managerial experience of the PI, and whether appropriate mentoring and support tools are in place, will be made to the Selecting Official, but these comments shall not impact the “Investigation Implementation Merit” rating.



Scientific Implementation Merit and Feasibility: Factor B-6

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Factor B-6. Merit of any science enhancement options (SEOs), if proposed.

This factor includes

- assessing the appropriateness of SEO activities to enlarge the science impact of the mission;
- the appropriateness of costing of the selected activities.
- This factor will have no impact on the proposal's overall rating for scientific implementation merit and feasibility.



Science Team Co-Is and Collaborators

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Science reviewers are generally active scientists, and must avoid conflicts of interest through their organizational affiliations and scientific activities. Rules for conflict of interest follow SPD-01A, as for research proposals. But every SMEX proposal competes with every other SMEX proposal, and every MO competes with every other MO.

- A reviewer with a conflict of interest with one SMEX proposal has a conflict with all of them; similarly for MOs.
- Thus if one SMEX proposal includes a Co-Investigator (or other funded participant) from organization X, no employee of organization X can review any SMEX proposal; similarly for MOs.
- Science collaborators, and hence the organizations that employ them, contribute effort to a proposal. Before inviting other scientists from such organizations as reviewers, we must consider scientific community standards on conflict of interest.

An over-large science team may result in a weakness on Criterion B-5, and reduces the reviewer pool. If all the experts in your field are on your science team, who will be eligible to review your proposal??